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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/739,620	12/20/2000	Noriaki Oda	Q61572	4739

7590

11/07/2003

SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC  
2100 Pennsylvania Avenue, N.W.  
Washington, DC 20037-3202

EXAMINER
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NGUYEN, HA T

ART UNIT	PAPER NUMBER
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2812

DATE MAILED: 11/07/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/739,620

Applicant(s)

ODA, NORIAKI

Examiner

Ha T. Nguyen

Art Unit

2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 11 August 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1, 2, 4, 5, 7-11 and 25-35 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 34 and 35 is/are allowed.
- 6) ☒ Claim(s) 1, 2, 4, 5, 7-9, 11, 25-30, 32 and 33 is/are rejected.
- 7) ☒ Claim(s) 10 and 31 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Notice to applicant***

1. Applicant's Amendment and Response to the Office Action mailed 4-9-3 and request for a continued examination have been entered and made of record. Following is an Office Action responding to the request.

### ***Response to Amendment***

2. In view of Applicant's arguments and the amendment to the claims, the rejections of claims 1, 2, 4, 5-9, 11, 25-30, 32, 33 under 35 U.S.C. 103, as stated in Paper No. 17, have been withdrawn.

Applicant's arguments with regard to the rejections under 35 U.S.C. 103 have been fully considered, but they are not deemed to be persuasive. The response to these arguments will be incorporated in the new ground of rejection given below.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 2, 4, 5, 7-9, 25-30, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mizushima (JP 590262) in view of Farkas et al. (USPN 6001730, hereinafter "Farkas") and Zhou et al. (USPN 6376353, hereinafter "Zhou").

[Claims 1, 2, 4, 5, 25-27, and 33] Referring to Figs. 1A-1D and related text, Mizushima discloses a semiconductor device comprising: a substrate 1 having a surface; a dielectric 7 formed over the surface of the substrate; and a wiring line buried in the dielectric layer; the wiring line including a conductor 14 and first cover layer 11 covering an outer surface of the conductor; the first cover layer being made of refractory metal containing compound (see

constitution); wherein the first cover layer entirely covers the outer surface of the conductor, note that the examiner interprets the outer surface of the conductor to be the surface surrounding the conductor; a third cover layer 13 provided between the conductor and the first cover layer; wherein the second cover layer covers entirely or partially the outer surface of the conductor; wherein the third cover layer covers entirely or partially the outer surface of the conductor, the third cover layer being made of dielectric. But it does not disclose expressly that the conductor is of Cu-based, the first cover layer is of refractory metal nitride, a second cover layer of refractory metal is provided between the conductor and the first cover layer, and the first cover layer covers at least a top surface of the conductor. However, the missing limitations are well known in the art because Zhou discloses a cover layer of refractory nitride 13, 25 surrounding and topping the Cu conductor 20 and Farkas discloses the use of Cu conductor 28 and a diffusion layer for Cu could be a combination of layers of Ta, TaN, TaSiN...etc (Sec col. 4, lines 48-58) when Farkas combination of layers, for example TaN and Ta, is used as diffusion barrier in place of conductive film designated as numeral 11 in Mizushima, the limitations of the claims are met. A person of ordinary skill is motivated to modify Mizushima with Farkas and Zhou to obtain reliable device at low cost with better protection against diffusion.

[Claims 7-9 and 28-30] Farkas also discloses wherein the dielectric formed over the surface of the substrate is made of inorganic material and has a relative dielectric constant ranging from 1.6 to 9; of organic material and has a relative dielectric constant ranging from 1.6 to 3; and where the wiring line has a damascene structure (see Fig. 4 and col. 4, lines 12-47).

Therefore, it would have been obvious to combine Mizushima with Farkas and Zhou to obtain the invention as specified in claims 1, 2, 4, 5, 7-9, 25-30, and 33.

5. Claims 11 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mizushima in view of Farkas and Zhou, as applied to claims 1, 2, 4, 5, 7-9, 25-30, and 33 above, and further in view of Nogami et al. (USPN 6214731, hereinafter "Nogami").

The combined teaching of Mizushima, Farkas, and Zhou discloses substantially the limitations of claims 11 and 32, as shown above.

But it does not disclose expressly a via hole of tapered shape with the claimed slope.

However, the missing limitation is well known in the art because Nogami discloses via hole of tapered shape having a slope similar to the claimed slope (See fig. 1A ). The combined teaching of Mizushima, Farkas, and Nogami does not disclose any specific angle of inclination. However any variation in angle of inclination in the present claims is obvious in light of the cited art, because the changes in angle of inclination produce no unexpected function.

The routine varying of parameters to produce expected changes are within the ability of one of ordinary skill in the art. Patentability over the prior art will only occur if the parameter variation produces an unexpected result. In re Aller, Lacey and Hall, 105 U.S.P.Q. 233, 235. In re Reese 129 U.S.P.Q. 402, 406.

A person of ordinary skill is motivated to modify Mizushima and Farkas with Nogami to obtain better filling of the contact hole.

Therefore, it would have been obvious to combine Mizushima, Farkas, and Zhou with Nogami to obtain the invention as specified in claims 11 and 32.

#### ***Allowable Subject Matter***

6. Claims 34 and 35 are allowed.

Claims 10 and 31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 10, 31, 34, and 35 recite "wherein the dielectric in which the wiring line is buried has a composite structure comprising a first dielectric layer, an etch stop layer formed on the first dielectric layer, and a second dielectric layer formed on the etch stop layer; and wherein a bottom surface of the first cover layer is approximately in a same level as an upper surface of the first dielectric layer; and wherein a top surface of the first cover layer is approximately in a same level as an upper surface of the second dielectric layer".

These features in combination with the other elements of the claims are neither disclosed nor suggested by the prior art of record.

*Conclusion*

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (703)308-2706 . The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The telephone number for Wednesday is (703) 560-0528.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Neibling, can be reached on (703) 308-3325. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



Ha Nguyen  
Primary Examiner  
10-28 - 03